3200 Series PID Temperature Controllers

ACS Custom Manual Issue 1.0

3216 Controllers

Issue 1 of this Handbook applies to software versions 2.09 and above for PID controller and includes:

- Remote Setpoint Input Option RCL
- Programmer Cycles

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1. Installation and Basic Operation

1.1 What Instrument Do I Have?

Thank you for choosing this 3200 series Temperature Controller/Programmer.

A universal input accepts various thermocouples, RTDs or process inputs. Up to three 3216 outputs can be configured for control, alarm or re-transmission purposes. Digital communications and a current transformer input are available as options.

The controller may have been ordered to a hardware code only or pre-configured using an optional 'Quick Start' code.

The label fitted to the side of the sleeve shows the ordering code that the controller was supplied to.

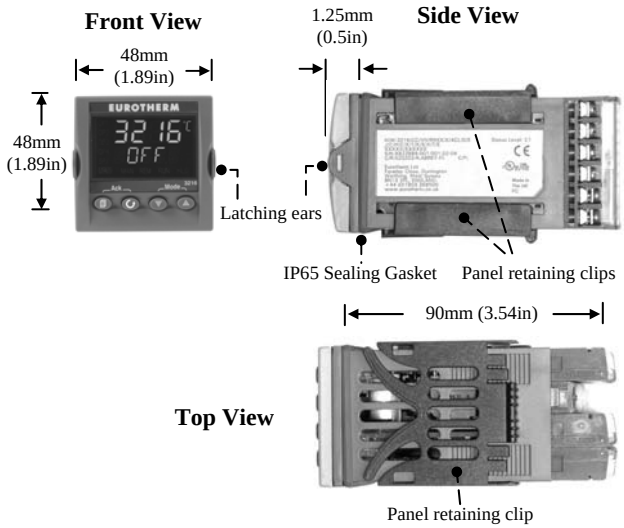
The last two sets of five digits show the Quick Code.

If the Quick Code shows *****/***** the controller was supplied with default parameters and will need to be configured when it is first switched on.

This Manual takes you through all aspects of installation, wiring, configuration and use of the controller. Dimensions

General views of the controllers are shown below together with overall dimensions.

3216



1.2 What Firmware Do I Have?

The startup screen will display the firmware version immediately on power up. Version 2.09 is the standard controller that is capable of communicating Modbus communications protocal. Version 2.50 is the standard controller that is capable of communicating SPI communications protocol.

Firmware V2.09 (Modbus)

Firmware V2.50 (SPI)

What Instrument Do I Have?

Order Code

1	2	3	4	5	6	7	8	9	10	11	12	13	14
3216													

1. Model No.	
1/16 DIN size	3216

2. Function	
Controller	CC
Programmer	CP
valve controller	VC
Valve programmer	VP

3. Power Supply	
24Vac/dc	VL
100–240Vac	VH

4. Outputs 1 and 2 3216			
OP1	OP2		
X	X	X	X
L	X	X	X
L	R	X	X
R	R	X	X
L	L	X	X
L	D	X	X
D	D	X	X
D	R	X	X
L	T	X	X
T	T	X	X

Triac not available with low voltage supply option.

L = Logic; R = Relay;

D = DC [1]; T = Triac

5. AA Relay (OP4)	
Disabled	X
Relay (Form C)	R

6. Options	
Not fitted	XXX
RS485 & Digital input A	4XL
RS232 & Digital input A	2XL
RS485, CT & Dig in A	4CL
RS232, CT & Dig in A	2CL
Digital input A	XXL
CT & Digital input A	XCL
Remote SP and Logic IP	RCL

7. Fascia colour/type	
Green	G
Silver	S
Wash down fascia [2]	W

8/9 Product/Manual Language	
English	ENG
French	FRA
German	GER
Italian	ITA
Spanish	SPA

10. Extended Warranty	
Standard	XXXXX
Extended	WL005

11. Certificates	
None	XXXXX
CERT1	Cert of conformity
CERT2	Factory calibration

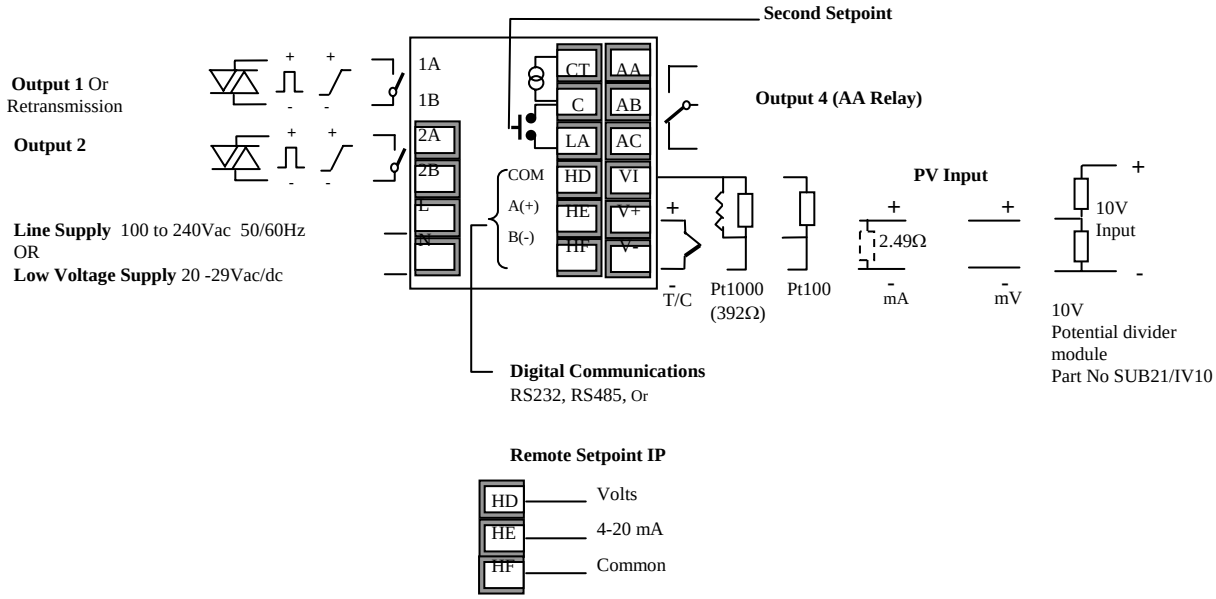
12. Custom Label	
XXXXX	None

13. Specials Number	
XXXXXX	None
RES250	250Ω ; 0-5Vdc OP
RES500	500Ω ; 0-10Vdc OP

2. Wiring

⚠ Ensure that you have the correct supply for your indicator
Check order code of the controller supplied

2.1 Terminal Layout 3216 Controller



Key to symbols used in wiring diagrams					
⎍	Logic (SSR drive) output	⊸	Relay output	⊸	Contact input
⎎	mA analogue output	⊸	Triac output	⊸	Current transformer input

3. Panel Layout

3.1 Front Panel Layout

ALM Alarm active (Red)

OP1 lit when output 1 is ON (normally heating)

OP2 lit when output 2 is ON (normally cooling)

OP3 lit when output 3 is ON

OP4 lit when output 4 relay is ON (normally alarm)

SPX Alternative setpoint in use (e.g. setpoint 2)

REM Remote digital setpoint. Also flashes when digital communications active

RUN Timer/programmer running

RUN (flashing) Timer/programmer in hold

MAN Manual mode selected

← Measured Temperature (or Process Value 'PV')

← Target Temperature (Setpoint 'SP')

Operator Buttons:-

From any display - press to return to the HOME display

Press to select a new parameter. If held down it will continuously scroll through parameters**.**

Press to decrease a value

Press to increase a value

3.1.1 To Set The Target Temperature.

From the HOME display:-

Press **to raise the setpoint**

Press **to lower the setpoint**

The new setpoint is entered when the button is released and is indicated by a brief flash of the display.

3.1.2 Alarms

Up to four process alarms may be configured. Each alarm can be configured for:-

Full Scale Low	The alarm is shown if the process value falls below a set threshold
Full Scale High	The alarm is shown if the process value rises above a set threshold
Deviation Low	The alarm is shown if the process value deviates below the setpoint by a set threshold
Deviation High	The alarm is shown if the process value deviates above the setpoint by a set threshold
Deviation Band	The alarm is shown if the process value deviates above and below the setpoint by a set threshold

If an alarm is not configured it is not shown in the list of level 2 parameters, section 5.3

Additional alarm messages may be shown such as CONTROL LOOP BROKEN. This occurs if the controller does not detect a change in process value following a change in output demand after a suitable delay time.

Another alarm message may be INPUT SENSOR BROKEN (5br). This occurs if the sensor becomes open circuit; the output level will adopt a 'SAFE' value which can be set up in Operator Level 2.

3.1.3 Alarm Indication

If an alarm occurs, the red ALM beacon will flash. A scrolling text message will describe the source of the alarm. Any output (usually a relay) attached to the alarm will operate. An alarm relay can be configured using the Quick Start Codes to be energised or de-energised in the alarm condition. It is normal to configure the relay to be de-energised in alarm so that an alarm is indicated if power to the controller fails.

Press **and** **(ACK) together to acknowledge**

If the alarm is still present the ALM beacon will light continuously otherwise it will go off.

The action which takes place depends on the type of alarm configured:-

Non latching	A non latching alarm will reset itself when the alarm condition is removed. By default alarms are configured as non-latching, de-energised in alarm.
Auto Latching	An auto latching alarm requires acknowledgement before it is reset. The acknowledgement can occur BEFORE the condition causing the alarm is removed.
Manual Latching	The alarm continues to be active until both the alarm condition is removed AND the alarm is acknowledged. The acknowledgement can only occur AFTER the condition causing the alarm is removed.

By default alarms are configured as non-latching, de-energised in alarm.

3.1.4 Auto, Manual and Off Mode

The controller can be put into Auto, Manual or Off mode – see next section.

Auto mode is the normal operation where the output is adjusted automatically by the controller in response to changes in the measured temperature.

In Auto mode all the alarms and the special functions (auto tuning, soft start, timer and programmer) are operative

Manual mode means that the controller output power is manually set by the operator. The input sensor is still connected and reading the temperature but the control loop is 'open'.

In manual mode the MAN beacon will be lit, Band and deviation alarm are masked, the auto-tuning timer and programmer functions are disabled.

The power output can be continuously increased or decreased using the ▲ or ▼ buttons.

⚠ **Manual mode must be used with care. The power level must not be set and left at a value that can damage the process or cause over-heating. The use of a separate 'over-temperature' controller is recommended.**

Off mode means that the heating and cooling outputs are turned off. The process alarm and analogue retransmission outputs will, however, still be active while Band and deviation alarm will be OFF.

3.1.5

To Select Auto, Manual or Off Mode

Press and hold ▲ and ▼ (Mode) together for more than 1 second.

This can only be accessed from the HOME display.

1. 'Auto' is shown in the upper display. After 5 seconds the lower display will scroll the longer description of this parameter. ie 'loop mode – auto manual off'

2. Press ▲ to select 'mAn'. Press again to select 'OFF'. This is shown in the upper display.

3. When the desired Mode is selected, do not push any other button. After 2 seconds the controller will return to the HOME display.

4. If **OFF** has been selected, OFF will be shown in the lower display and the heating and cooling outputs will be off

5. If manual mode has been selected, the **MAN** beacon will light. The upper display shows the measured temperature and the lower display the demanded output power.

☺ The transfer from Auto to manual mode is 'bumpless'. This means the output will remain at the current value at the point of transfer. Similarly when transferring from Manual to Auto mode, the current value will be used. This will then slowly change to the value demanded automatically by the controller.

6. To manually change the power output, press ▼ or ▲ to lower or raise the output. The output power is continuously updated when these buttons are pressed

7. To return to Auto mode, press ▲ and ▼ together. Then press ▲ to select 'Auto'.

4. Operator Level 1

4.1.1 Level 1 Operator Parameters

A minimal list of parameters are available in operator Level 1 which is designed for day to day operation. Access to these parameters is not protected by a pass code.

Press to step through the list of parameters. The mnemonic of the parameter is shown in the lower display. After five seconds a scrolling text description of the parameter appears.

The value of the parameter is shown in the upper display. Press or to adjust this value. If no key is pressed for 30 seconds the controller returns to the HOME display

The parameters that appear depend upon the functions configured. They are:-

Home List

Parameter Mnemonic	Scrolling Display and Description	Alterability
WRK.OP	WORKING OUTPUT The active output value	Read only. Appears when the controller is in AUTO or OFF mode. In a motorised valve controller (option VC or VP) this is the 'inferred' position of the valve
A.TUNE	AUTO TUNE Activate Auto Tune Of PID Loop.	Alterable
SP1	SETPOINT 1	Alterable
SP2	SETPOINT 2	Alterable
T.REMN	TIME REMAINING Time to end of set period	Read only 0:00 to 99.59 hh:mm or mm:ss
DWELL	SET TIME DURATION Timer set time	Alterable. Only shown if timer (not programmer) configured.
DEC.P	DECIMAL POINT	Read only
UNITS	DISPLAY UNITS	Read Only
PB	PROPORTIONAL BAND	Alterable
TI	INTEGRAL TIME	Alterable
TD	DERIVATIVE TIME	Alterable
R2G	RELATIVE COOL GAIN	Read Only
OP.HI	OUTPUT HIGH LIMIT	Read Only
ADDR	COMMS ADDRESS	Read Only

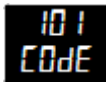
5. Operator Level 2

Level 2 provides access to additional parameters. Access to these is protected by a security code.

5.1 To Enter Level 2

1. From any display press and hold .
2. After a few seconds the display will show:-
3. Release .

(If no button is pressed for about 45 seconds the display returns to the HOME display)

4. Press or to choose LEu 2 (Level 2
5. After 2 seconds the display will show:-
6. Press or to enter the pass code. = '101' 

- If an incorrect code is entered the controller reverts to Level 1.

5.2 To Return to Level 1

1. Press and hold
2. Press to select LEu 1

The controller will return to the level 1 HOME display.
Note: A security code is not required when going from a higher level to a lower level.

5.3 Level 2 Parameters

Press to step through the list of parameters. The mnemonic of the parameter is shown in the lower display. After five seconds a scrolling text description of the parameter appears.

The value of the parameter is shown in the upper display. Press or to adjust this value. If no key is pressed for 30 seconds the controller returns to the HOME display

Backscroll is achieved when you are in this list by pressing while holding down .

The following table shows a list of parameters available in Level 2.

6. Access to Further Parameters

Parameters are available under different levels of security and are defined as Level 1 (Lev1), Level 2 (Lev2), Level 3 (Lev 3) and Configuration (Conf).

Level 1 has no passcode since it contains a minimal set of parameters generally sufficient to run the process on a daily basis.

Level 2 allows access to parameters which may used in commissioning a controller or settings between different products or batches.

Level 1 and Level 2 operation has been described in the previous sections.

Level 3 and Configuration level parameters are also available as follows:-

6.1.1 Level 3

Level 3 makes all operating parameters available and alterable (if not read only). It is typically used when commissioning a controller.

Examples of parameters available in Level 3 are:-

Range limits, setting alarm levels, communications address.

The instrument will continue to control when in Levels 1, 2 or 3.

6.1.2 Configuration Level

This level makes available all parameters including the operation parameters so that there is no need to switch between configuration and operation levels during commissioning. It is designed for those who may wish to change the fundamental characteristics of the instrument to match the process.

Examples of parameters available in Configuration level are:-

Input (thermocouple type); Alarm type; Communications type.

WARNING

Configuration level gives access to a wide range of parameters which match the controller to the process. Incorrect configuration could result in damage to the process being controlled and/or personal injury. It is the responsibility of the person commissioning the process to ensure that the configuration is correct.

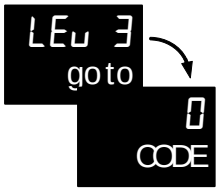
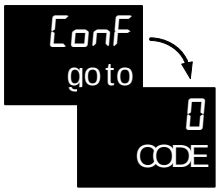
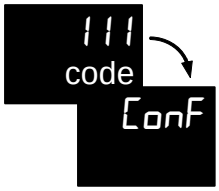
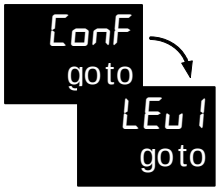
In configuration level the controller is not controlling the process or providing alarm indication. Do not select configuration level on a live process.

Operating Level	Home List	Full Operator	Configuration	Control
Level 1	✓			Yes
Level 2	✓			Yes
Level 3	✓	✓		Yes
Conf	✓	✓	✓	No

6.1.3 Selecting Recipes (Configuration Level)

Recipes can be selected from Level 3 or the Configuration Level. After successfully entering the password in either of these levels, the button until RECIP appears in the lower display. Press the button once to enter the RECIPE menu. Press the arrow buttons to select the desired recipe. Press the button to exit the RECIPE menu.

6.1.4 To Select Access Level 3 or Configuration Level

Do This	The Display You Should See	Additional Notes
1. From any display press and hold for more than 5 seconds	**To Select Level 3** 	The display will pass from the current operating level, for example, LEu 1 to LEu 3 as the button is held down. (If no button is then pressed for about 50 seconds the display returns to the HOME display)
2. Press or to enter the passcode for Level 3		The Level 3 code is 11: If an incorrect code is entered the display reverts to 'goto'. The controller is now in the level 3 will then revert to the HOME display
3. When the LEU3 GOTO view is shown, as in paragraph 1 above, press to select 'ConF'	**To Select Configuration level** 	Note: must be pressed **quickly** (within 2 seconds) before the controller requests the code for level 3 (If no button is then pressed for about 50 seconds the display returns to the HOME display)
4. Press or to enter the passcode for Configuration level		The configuration code is 111: If an incorrect code is entered the display reverts to 'goto'. The controller is now in Configuration level will now show ConF
5. Press and hold for more than 3 seconds 6. Press to select the required level eg LEV 1	**To Return to a Lower Level** 	The choices are: LEU 1 Level 1 LEU 2 Level 2 LEU 3 Level 3 ConF Configuration It is not necessary to enter a code when going from a higher level to a lower level. Alternatively, press and scroll to the Acces list header, then press to select the required level. The display will then flash 'ConF' for a few seconds and the controller will then go through its start up sequence, starting in the level selected. Do not power down while ConF is flashing. If a power down does occur an error message will appear.

☺ A special case exists if a security code has been configured as '0' If this has been done it is not necessary to enter a code and the controller will enter the chosen level immediately.

☺ When the controller is in configuration level the ACCESS list header can be selected from any view by holding down the button for more than 3 seconds. Then press again to select 'ACCES'

6.2 Parameter lists

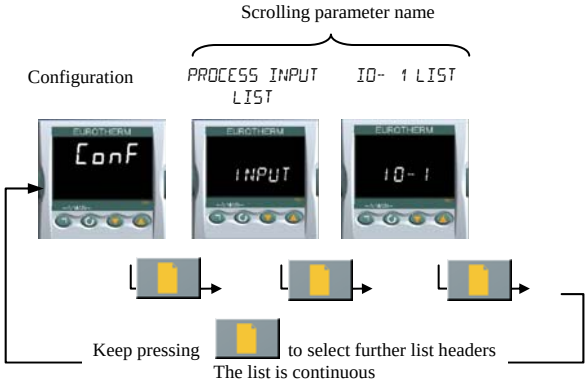
Parameters are organised in lists. The top of the list shows the list header only. The name of the list header describes the generic function of the parameters within the list. For example, the list header 'ALARM' contains parameters which enable you to set up alarm conditions.

6.2.1 To Choose Parameter List Headers

Press . Each list header is selected in turn every time this key is pressed.

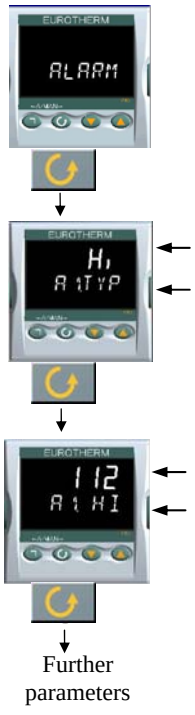
The name of the list header appears in the lower display, followed, after a few seconds, by a scrolling longer description of the name.

The following example shows how to select the first two list headers. (Views are shown for 3216 controllers).



6.2.2 To Locate a Parameter

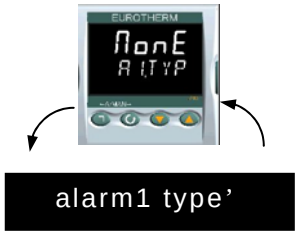
Choose the appropriate list, then press . Each parameter in the list is selected in turn each time this button is pressed. The following example shows how to select the first two parameters in the ALARM List. All parameters in all lists follow the same procedure. (Views are shown for 3216 controllers).


ALARM
Alarm List Header
Parameter 'Value'. In this case set to Full Scale High Alarm
Parameter mnemonic 'a1.typ' followed by a scrolling message 'alarm1 type'
Parameter 'Value'. In this case an 'numerical' value, set to '112'
Parameter mnemonic 'a1.HI' followed by a scrolling message 'alarm 1 setpoint'
Press to jump back to the list header.
Further parameters

6.2.3 How Parameters are Displayed

As shown above. whenever a parameter is selected it is displayed as a mnemonic, of four or five characters, for example 'A1.TYP'.

After a few seconds this display is replaced by a scrolling banner which gives a more detailed description of the parameter. In this example 'A1.TYP' = 'alarm 1 type'. The scrolling banner is only shown once after the parameter is first accessed. (Views are shown for 3216 controllers).



The name of the list header is also displayed in this way.

The upper part of the display shows the value of the parameter.

The lower part shows its mnemonic followed by the scrolling name of the parameter

6.2.4 To Change a Parameter Value

With the parameter selected, press to increase the value, press to decrease the value. If either key is held down the analogue value changes at an increasing rate.

The new value is entered after the key is released and is indicated by the display blinking. The exception to this is output 'Power' when in manual. In this case the value is entered continuously.

The upper display shows the parameter value the lower display shows the parameter name.

6.2.5 To Return to the HOME Display

Press + .

On release of the keys the display returns to the HOME list. The current operating level remains unchanged.

6.2.6 Time Out

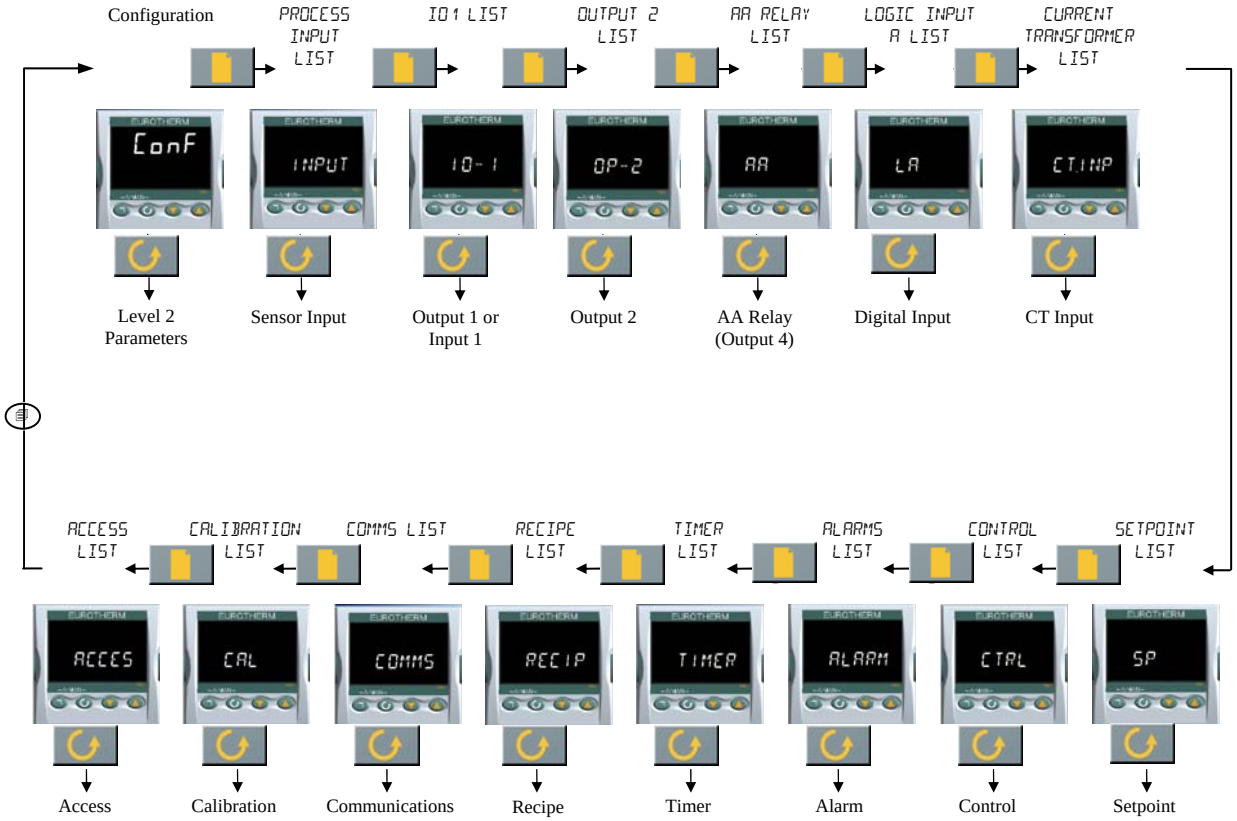
A time out applies to the 'Go To' and 'Control Mode' parameters. If no key presses are detected within a period of 5 seconds the display will revert back to the HOME list.

☺ Press and hold to scroll parameters forward through the list. With depressed, press to scroll parameters backward.

6.3 Navigation Diagram

The diagram below shows the all list headings available in configuration level for 3216 controllers.

The parameters in a list are shown in tables in the following sections of this manual together with explanations of their meanings and possible use.



7. Custom Scrolling Text

The 3216 has custom scrolling text used to provide detailed information about the status of the process. The scrolling text will appear in the lower readout of the display. The following is a list of custom scrolling text messages used.

Controller	Scrolling Display	Description
Water Unit (TCU)	VENTING IN PROCESS	On power up, the vent valve opens for 60 seconds to allow air to bleed out of the system. This text displays for the 60seconds.
1 Compressor Chiller	COMPRESSOR ON	This text displays when the compressor turns on. It will remain on until the compressor turns off.
1 Compressor Chiller	COMPRESSOR OFF	This text displays when the compressor turns off. It will remain on until the compressor turns on.
2 Compressor Chiller	COMPRESSOR A ON COMPRESSOR B ON	This text displays when either or both compressors are on. It will remain on until either or both compressors turn off.

Custom Configurations

See Appendix B for tables summarizing the parameter values for each of the custom configurations.

7.1.1 Master Parameter List

INPUT LIST INPUT						
Name	Scrolling Display	Parameter Description	Value		Default	Access Level
IN.TYP	INPUT TYPE	Selects input linearisation and range	See manufacture manual for input types available			Conf L3 R/O
UNITS	DISPLAY UNITS	Display units shown on the instrument	none	No units - only for custom linearisation	°C	L3
			°C	Celsius		
			°F	Fahrenheit		
			°K	Kelvin		
			PErc	%		
DEC.P	DISPLAY POINTS	Decimal point position	nnnn	No DP	nnnn	Conf L3 R/O
			nnn.n	One DP		
			nn.nn	Two DP		
MV.HI	LINEAR INPUT HIGH	High limit for mV (mA) inputs	-10.00 to +80.00mV		80.00	Conf
MV.Lo	LINEAR INPUT LOW	Low limit for mV (mA) inputs	-10.00 to +80.00mV		-10.00	Conf
RNG.HI	RANGE HIGH LIMIT	Range high limit for thermocouple RTD and mV inputs	From the high limit of the selected input type to the 'Low Range Limit' parameter minus one display unit.			Conf L3 R/O
RNG.LO	RANGE LOW LIMIT	Range low limit for thermocouple RTD and mV inputs	From the low limit of the selected input type to the 'High Range Limit' parameter minus one display unit.			Conf L3 R/O
PV.OFS	PV OFFSET	A simple offset applied to all input values.	Generally one decimal point more than PV			L3
FILT.T	FILTER TIME	Input filter time	OFF to 100.0 seconds		1.6	L3
CJ.typ	CJC TYPE	Configuration of the CJC type	Auto	Automatic	Auto	Conf and if T/C L3 R/O
			0°C	Fixed at 0°C		
			50°C	Fixed at 50°C		
SB.typ	SENSOR BREAK TYPE	Defines the action which is applied to the control output if the sensor breaks (open circuit).	oFF	No sensor break will be detected	on	Conf L3 R/O
			on	Open circuit sensor will be detected		
			LAt	Latching		
CJC.in	CJC TEMPERATURE	Temperature measured at the rear terminal block. Used in the CJC calculation	Read only			Conf L3 R/O and if T/C
Pv.in	PV INPUT VALUE	Current measured temperature	Minimum display to maximum display range			Conf L3 R/O
mv.in	MILLIVOLT INPUT VALUE	Millivolts measured at the rear PV Input terminals	xx.xx mV - read only			Conf L3 R/O

INPUT/OUTPUT LIST 1 'IO-1'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
1..id	I/O 1 TYPE	I/O channel 1 hardware type defined by the hardware fitted	none	No input or output fitted	As ordered	Read only
			dC.OP	DC output		
			rELY	Relay output		
			LIO	Logic Input/Output		
			SSr	Triac output		
1.FUNC	I/O 1 FUNCTION	I/O channel function. If the instrument is ordered as valve positioner (codes VC or VP), only options available are , none, dout, UP, or dwn **Note: If output 1 is set to UP ensure the other valve position output is set to dwn and vice versa**	none	Disabled. If disabled no further parameters are shown	HEAt	Conf
			dout	Digital output		
			UP	Valve open codes VC and VP only		
			dwn	Valve close codes VC and VP only		
			HEAt	Heat output		
			CooL	Cool output		
			din	Digital input if '1.id' = 'LIO'		
			w.SP	Working setpoint re-transmission	Shown if I/O 1 TYPE = dc.OP Retransmission	
			PV	Process variable re-transmission		
			OP	Output power demand re-transmission		

INPUT/OUTPUT LIST 1 'IO -1 '						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
1.SRC.A	I/O 1 SOURCE A	These parameters only appear when the channel function is a Digital output, i.e. 1.FUNC = d.out Selects an event status to be connected to the output channel. The output status is the result of an OR of Src A, Src B, Src C, and Src D Up to four events can, therefore, operate the output	nonE	No event connected to the output	nonE	Conf
1.SRC.B	I/O 1 SOURCE B		AL 1	Alarm 1		
1.SRC.C	I/O 1 SOURCE C		AL2	Alarm 2		
1.SRC.D	I/O 1 SOURCE D		AL3	Alarm 3		
			AL4	Alarm4		
			ALL.A	All alarms		
			nw.AL	Any new alarm		
			CT.AL	CT alarm, load, leak & overcurrent		
			Lbr	Loop break alarm		
			Sbr	Sensor break alarm		
			t.End	Timer end status		
			t.run	Timer run status		
			mAn	Manual status		
			rmt.F	Remote fail		
			Pwr.F	Power fail		
			PrG.E	Programmer event.		
1.D.IN	DIGITAL INPUT FUNCTION	This parameter is only applicable to I/O 1 and only appears if the channel function is a Digital IP i.e. 1.FUNC = di n Only one function may be activated by a physical input	nonE	Input not used	AcAL	Conf
			AcAL	Alarm acknowledge		
			SP2	Setpoint 2 select		
			Loc.b	Front keypad disable (keylock)		
			trES	Timer/programmer reset		
			t.run	Timer/programmer run		
			trrS	Timer/programmer run/reset. Make to run, break to reset		
			t.HLd	Timer/programmer hold		
			mAn	Manual status		
			Sby	Standby mode. In this mode control outputs go to zero demand		
			rmt	Remote digital setpoint select		
			rEc	Recipe select through IO1 digital input		
			UP	Remote key 'Up'		
			dwn	Remote key 'Down'		
1.PLS	OUTPUT 1 MINIMUM PULSE TIME	Minimum output on/off time. Only applies to time proportioning outputs and prevents relays from switching too rapidly	0.0 to 150.0	Auto or 1.0 to 150.0 seconds Auto = 110mS	5.0 sec for relay. Auto for logic	Conf
1.SENS	I/O 1 SENSE	To configure the sense of the input or output channel	nor	Normal	nor	Conf
			inv	Inverted		
1.rng	DC OUTPUT RANGE	To configure 0-20mA or 4-20mA output Only appears if the output module is DC output	0.20	0-20mA output		L3
			4.20	4-20mA output		

OUTPUT LIST 2 'op-2'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
2.id	OUTPUT 2 TYPE	Output channel 2 hardware type	nonE	Output not fitted	As ordered	Read only
			rELY	Relay output		
			LOP	Logic output (3200 only)		
			dC.OP	0-20mA output.		
			SSr	Triac output		
2.FUNC	FUNCTION	Output channel 2 function If the instrument is ordered as valve positioner (codes VC or VP), only options available are , nonE, d.out, UP, or dwn **Note: If output 2 is set to UP ensure the other valve position output is set to dwn**	nonE	Disabled. If disabled no further parameters are shown	d.out	Conf
			d.out	Digital output		
			UP	Valve open codes VC and VP only		
			dwn	Valve close codes VC and VP only		
			HEAt	Heat output		
			CooL	Cool output		
			w.SP	Working setpoint re-transmission	Shown if I/O 2 TYPE = dc.OP Retransmission	
			PV	Process variable re-transmission		

		and vice versa	OP	Output power demand re-transmission		
2.SRC.A	I/O 2 SOURCE A	These parameters only appear when the channel function is a Digital OP, i.e. 2.FUNC = dOut Selects an event status to be connected to the output channel. The output status is the result of an OR of Src A, Src B, Src C, and Src D Up to four events can, therefore, operate the output	nonE	No event connected to the output	nonE	Conf
2.SRC.B	I/O 2 SOURCE B		AL1	Alarm 1 *		
			AL2	Alarm 2 *		
2.SRC.C	I/O 2 SOURCE C		AL3	Alarm 3 *		
			AL4	Alarm4 *		
2.SRC.D	I/O 2 SOURCE D		ALLA	All alarms		
			nwAL	Any new alarm		
			CtAL	CT alarm, load, leak & overcurrent		
			Lbr	Loop break alarm		
			Sbr	Sensor break alarm		
			t.End	Timer end status		
			trun	Timer run status		
			mAn	Manual status		
			rmtF	Remote fail		
			PwrF	Power fail		
			PrG.E	Programmer event.		
2.PLS	OUTPUT MINIMUM PULSE TIME	Minimum output on/off time. Only applies to time proportioning outputs and prevents relays from switching too rapidly	0.0 to 150.0	Auto or 1.0 to 150.0 seconds Auto = 110mS	5.0 sec for relay Auto for logic	Conf
2.SENS	SENSE	To configure the polarity of output channel 2	nor	Normal	nor	Conf
			Inv	Inverted		
2.rng	DC OUTPUT RANGE	To configure 0-20mA or 4-20mA output Only appears if the output module is DC output	0.20	0-20mA output		L3
			4.20	4-20mA output		

AA RELAY 'aa'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
4.TYPE	OUTPUT 4 TYPE	Output channel 4 hardware type	rELY	Relay output	rELY	Read only
4.FUNC	FUNCTION	Output channel 4 function If the instrument is ordered as valve positioner (codes VC or VP), only options available are , nonE, d.out, UP, or dwn **Note: If output 4 is set to uP ensure the other valve position output is set to dwn and vice versa**	nonE	Disabled	d.OUt	Conf
			dOUt	Digital output		
			UP	Valve open codes VC and VP only		
			dwn	Valve close codes VC and VP only		
			HEAt	Heat output		
			CooL	Cool output		
4.SRC.A	I/O 4 SOURCE A	These parameters only appear when the channel function is a Digital OP, i.e. 4.FUNC = dOut Selects an event status to be connected to the output channel. The output status is the result of an OR of Src A, Src B, Src C, and Src D Up to four events can, therefore, operate the output	nonE	No event connected to the output	nonE	Conf
4.SRC.B	I/O 4 SOURCE B		AL1	Alarm 1 *		
			AL2	Alarm 2 *		
4.SRC.C	I/O 4 SOURCE C		AL3	Alarm 3 *		
			AL4	Alarm4 *		
4.SRC.D	I/O 4 SOURCE D		ALLA	All alarms		
			nwAL	Any new alarm		
			CtAL	CT alarm, load, leak & overcurrent		
			Lbr	Loop break alarm		
			Sbr	Sensor break alarm		
			t.End	Timer end status		
			trun	Timer run status		
			mAn	Manual status		
			rmtF	Remote fail		
			PwrF	Power fail		
			PrG.E	Programmer event.		
4.PLS	OUTPUT MINIMUM PULSE TIME	Minimum output on/off time. Only applies to time proportioning outputs and prevents relays from switching too rapidly	0.0 to 150.0	0 to 150 seconds	5.0 sec	Conf

4.SENS	SENSE	To configure the polarity of output channel 4	nor	Normal	nor	Conf
			InU	Inverted		

LOGIC INPUT LIST 'IA' / 'LB'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
L.TYPE	LOGIC INPUT TYPE	Input channel type	LJP	Logic input	As order code	Conf Read only
L.d.in	LOGIC INPUT FUNCTION	To configure the function of the digital input	nonE	Input not used	AcAL	Conf
			AcAL	Alarm acknowledge		
			SP2	Setpoint 2 select		
			Loc.b	Front keypad disable		
			t.rES	Timer/programmer reset		
			t.run	Timer/programmer run		
			t.rr5	Timer/programmer run/reset. Make to run, break to reset		
			t.HLd	Timer/programmer hold		
			mAn	Manual status		
			Sby	Standby mode. In this mode control outputs go to zero demand		
			rmt	To allow a remote setpoint to be selected through the LA digital input.		
			rEc	Recipe select through IO1 digital input		
			UP	Remote key 'Up'		
			dwn	Remote key 'Down'		
L.SENS	LOGIC INPUT SENSE	To configure the polarity of the input channel	nor	Normal	nor	Conf
			InU	Inverted		
			4.20	4-20mA output		

SETPOINT LIST 'SP'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
SP.SEL	SETPOINT SELECT	This enables the main or secondary setpoint to be selected form the front panel buttons	SP1	Setpoint 1 selected	SP1	L3
			SP2	Setpoint 2 selected		
SP1	SETPOINT 1	Main or normally selected setpoint	Low to high setpoint limits		0	L3
SP2	SETPOINT 2	Secondary or standby setpoint	Low to high setpoint limits		0	L3
SP.HI	SETPOINT HIGH LIMIT	Maximum allowable setpoint setting	Setpoint low limit (SP.LO) to high range limit. Also limited by the rNG.HI and rNG.LO parameters		Range High Limit	L3
SP.LO	SETPOINT LOW LIMIT	Minimum allowable setpoint setting	Low range limit to Setpoint high limit (SP.HI). Also limited by the rNG.HI and rNG.LO parameters		Range Low Limit	L3
rEm.sp	REMOTE SETPOINT	Reads the current remote setpoint value when remote setpoint is in use				Read only
l-r	REMOTE SETPOINT SELECT	To select the remote digital communications setpoint	no	Not selected	no	Conf
			YES	Selected		
SP.RAT	SETPOINT RATE LIMIT	Limits the rate of change of the setpoint. Operates on both SP1 and SP2	Step change (OFF) or 0.1 to 3000 display units per minute. Resolution one decimal place more than PV		OFF	L3
rampu	SETPOINT RAMP UNITS	To set the units for the setpoint rate limit	min	Minutes	min	L3
			Hour	Hours		
			SEC	Seconds		
loc.t	LOCAL SETPOINT TRIM	To apply a fixed offset to the setpoint in use	-199.9 to 300.0		0.0	L3
REM.HI	REMOTE INPUT HIGH SCALAR	Sets the maximum scale limit for the remote setpoint	Between Range High and Low Limits			L3
REM.lo	REMOTE INPUT LOW SCALAR	Seta the minimum scale limit for the remote setpoint				

CONTROL LIST	**'CTRL'**				
Parameter Name	Parameter Description (Scrolling Display)	Value		Default	Access Level
CTRL.H	HEATING TYPE Selects the channel 1 control algorithm. Different algorithms may be selected for channels 1 and 2. In temperature control applications, Ch1 is usually the heating channel, Ch2 is the cooling channel.	PID	PID	As order code	Conf
		oFF	Heating off		
		on.oF	On/Off		
		mtr	Valve position control		
CTRL.C	COOLING TYPE Selects the channel 2 Control algorithm. Different algorithms may be selected for channels 1 and 2. This is not available if the instrument is a valve position controller	oFF	Cooling disable	As order code	Conf
		PID	PID		
		on.oF	On/Off		
CTRL.A	CONTROL ACTION Selects the direction of the control. i.e reverse or direct acting.	rEu	Reverse acting. Output decreases as PV increases	rEu	Conf
		dir	Direct acting. Output increases as PV decreases		
PB.UNT	PROPORTIONAL BAND UNITS	EnG	In engineering units		
		PErc	In percent		
ATUNE	AUTO-TUNE ENABLE	OFF	Autotune off	OFF	L3
		On	Set to 'on' to start auto-tuning		
PB	PROPORTIONAL BAND	0.1 t 9999 display units or 1 to 999.9% if proportional band expressed as %		20	L3
TI	INTEGRAL TIME	OFF to 9999 seconds		360 sec	L3
TD	DERIVATIVE TIME	OFF to 9999 seconds TD defaults to OFF for valve position control		60 sec	L3
R2G	RELATIVE COOL GAIN	0.1 to 10.0		1.0	L3
CBHi	CUTBACK HIGH	Auto or 1to 3000 display units		Auto = 3xPb	L3
CBLo	CUTBACK LOW	Auto or 1 to 3000 display units		Auto = 3XPb	L3
MR	MANUAL RESET	0.0 to 100.0% (heat only) -100.0 to 100.0% (heat/cool)		0.0%	L3
LBT	LOOP BREAK TIME The loop break alarm attempts to detect loss of restoring action in the control loop by checking the control output, the process value and its rate of change. Loop break detection works for all control algorithms: PID, VP and ON-OFF. Note: This is not to be confused with load failure and partial load failure.	OFF	Setting loop Break Time to OFF disables the Loop Break Alarm	OFF	L3
		1 to 9999 minutes			
OP.HI	OUTPUT HIGH Adjust to limit the maximum heating power applied to the process	±100.0%		100.0%	L3
OP.LO	OUTPUT LOW Adjust to limit the maximum cooling power applied to the process or to apply a minimum heating power	±100.0%		0.0 (heat only) -100 (cool)	L3
MTR.T	MOTOR TRAVEL TIME Set this value to the time that it takes for the motor to travel from its fully closed to its fully open position.	0.0 to 999.9 seconds Note: In motorised valve control only the PB and TI parameters are active. The TD parameter has no effect on the control.		0.0	L3
D.BAND	CHANNEL 2 DEAD BAND Period when no output is demanded from either channel 1 or channel 2 Adjust, for example, to increase the period when no heating or cooling power is applied	OFF or 0.1 to 100.0% of the cooling proportional band		OFF	L3
HYST.H	HEATING HYSTERESIS	-199.9 to 200.0 display units		1	L3 On/off only
HYST.C	COOLING HYSTERESIS	-199.9 to 200.0 display units		1	

SAFE	SAFE OUTPUT POWER To set the output level in a sensor break (open circuit) condition	-100.0 to 100.0% limited by OP.HI and OP.LO		0.0%	L3
F.MOD	FORCED MANUAL OUTPUT MODE Selects how the loop behaves on transfer from Auto to Manual. Transfer from Manual to Auto is always bumpless.	nonE	Transfer between Auto/Manual/Auto is bumpless	nonE	L3
		StEP	Transfer from Auto to Manual, the output goes to a pre-set value (F.OP)		
		LASt	Transfer from Auto to Manual, the output goes to the previously set manual value		
Cool.t	NON-LINEAR COOLING TYPE This selects an algorithm most suited to the type of cooling. Typically used in extruders.	Lin	Linear	As order code	Conf
		OIL	Oil cooling		
		H2O	Water cooling		
		FAn	Forced air cooling		
F.OP	FORCED OUTPUT To pre-set a value for the Manual output when F.MOD = STEP	-100.0 to 100.0% limited by OP.HI and OP.LO		0.0	L3
A-M	LOOP MODE – AUTO MANUAL OFF	Auto	To select automatic operation		L3
		mAn	To select manual operation		
		OFF	Control outputs inhibited		
Ibr	LOOP BREAK STATUS	no	Shows the current status of loop break.		Read only
		YES			

ALARM LIST	**'ALARM'**						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
A1.TYP	ALARM 1 TYPE	Selects the type of alarm	nonE	Alarm not configured	As order code	Conf
			HI	Full Scale High		
			Lo	Full Scale Low		
			dHI	Deviation High		
			dLo	Deviation Low		
			bnd	Deviation band		
A1.---	ALARM 1 SETPOINT	Alarm 1 threshold value. The last three characters show the type of alarm configured from the above list	Instrument range		0	L3
A1.sts	ALARM 1 OUTPUT	Indicates the status of the alarm	OFF	Alarm off		Read only
			On	Alarm on		
A1.HYS	ALARM 1 HYSTERESIS	See description in manufacture manual	0 to 9999			Conf
A1.LAT	ALARM 1 LATCHING TYPE	See description in manufacture manual	nonE	Non-latching	As order code	Conf
			Auto	Latching with automatic resetting		
			mAn	Latching with manual resetting		
			Evt	Event (no alarm flashing beacon but messages can be displayed)		
A1.BLK	ALARM 1 BLOCKING	See description in manufacture manual	no	No blocking	no	Conf
			YES	Blocking		
The above parameters are repeated for Alarm 2, A2; Alarm 3, A3; Alarm 4, A4						

TIMER LIST	**'timer''**						
Name	**Scrolling Display**	**Parameter Description**	**Value**			**Default**	**Access Level**
TM.CFG	TIMER CONFIGURATION	Timer type configuration	nonE	Timer disabled		As order code	L3
			dwEll	Dwell			
			dELY	Delayed switch on			
			SFSt	Soft start			
			Prog	Programmer			
TM.res	TIMER RESOLUTION	To set the time units	Hour	Hours	HH:MM		Conf R/O L3
			min	Minutes	MM:SS		

TIMER LIST	'timer''					
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
THRES	TIMER START THRESHOLD	To set the maximum deviation between SP and PV before the timer starts. **Dwell timer and Programmer only**	OFF or 1 to 3000 Units above and below setpoint		OFF	L3
ENd.T	TIMER END TYPE	To determine the action which takes place when the timer has timed out. **Dwell timer and Programmer only**	OFF	Control outputs go to zero %		Conf
			dwEll	Control continues at SP1		
			SP2	Go to setpoint 2		
			rES	Reset programmer		
SS.SP	SOFT START SETOINT	Sets the threshold below which the power is limited SFSt **timer only**	Controller input range		0	Conf
SS.PWR	SOFT START POWER LIMIT	Sets the limit to the power output during start up SFSt **timer only**	0 to 100%		0	Conf
T.STAT	TIMER STATUS	Timer status	rES	Reset		L3
			run	Running (counting)		
			hoLd	Running (hold)		
			End	Timed out		
servo	SERVO MODE	Defines the way in which the programmer starts and how it recovers from a power failure **Programmer only**	SP	Starts at SP1 (or SP2). The program must be re-started after a power failure.	SP	
			PU	Starts at the current Process value. The program must be re-started after a power failure.		
			SPrb	Starts at SP1 (or SP2). The program will continue to run from the original setpoint value at the last ramp rate.		
			Purb	Starts at the current Process value. The program will continue to run from the current process value and ramp back at the last ramp rate		
Tsp.1	TARGET SETPOINT 1	To set the target value for the first setpoint	Controller input range		0	L2
Rmp.1	RAMP RATE 1	To set the rate at which the setpoint changes to reach TSP.1	OFF, 0:1 to 3000 units per min or hour		OFF	L2
Dwel.1	DWELL 1	To set the time at which the setpoint remains at TSP.1	OFF, 0:01 to 99:59 hh:mm or mm.ss		OFF	L2
The above three parameters are repeated for the next 3 program segments, i.e. TSP.2, (3 & 4), RMP.2 (3 & 4), DWEL.2 (3 & 4)						
dwell	SET TIMER DURATION	To set the time duration **(not programmer)**	0:00 to 99:59 hh:mm or mm.ss		0	L3
T.ELAP	ELAPSED TIME	Time elapsed from when the timer starts to run	0:00 to 99.59 hh:mm or mm.ss			L3 read only
T.REMN	TIME REMAINING	Time remaining to reach the set time.	0:00 to 99.59 hh:mm or mm.ss			L3
event	EVENT OUTPUTS	Event output operates during the selected segment **Programmer only**	0 = No events operate in any segment 255 -= Events operate in all segments		0	L3
p.cycl	PROGRAM CYCLES	Sets the number of times that a program is repeated	1 to 100		1	L3
cycle	PROGRAM CYCLE	Displays the current cycle when the program is running	1 to 100			L3
The timer can be restarted from the Reset condition by changing the time remaining parameter.						

CALIBRATION PARAMETER LIST	'cAL'

Name	Scrolling Display	Parameter Description	Value		Default	Access Level
ucal	USER CALIBRATION	To select low and high offset state or reset to no offsets.	idLE	Normal operating state	idLE	L3 only
			Lo	Low offset		
			Hi	High offset		
			rESt	Remove high and low offsets		
The following parameters appear when calibrating the controller ie UCAL = Lo or Hi						
c.adj	CALIBRATION ADJUST	To set an offset value.	-1999 to 9999			L3 only
phase	CAL PHASE	To calibrate low and high offset	nonE	Not selected	nonE	Conf only
			0	Select mV low calibration point		
			50	Select mV high calibration point		
			150r	Select PRT low cal point		
			400r	Select PRT high cal point		
			CJC	Select CJC calibration		
			Ct 0	Select CT low cal point		
			Ct 70	Select CT high cal point		
			FAct	Return to factory settings		
			1mA.L	Low mA output from I/O 1		
			1mA.H	High mA output from I/O 1		
			2mA.L	Low mA output from output 2		
			2mA.H	High mA output from output 2		
			3mA.L	Low mA output from output 3		
			3mA.H	High mA output from output 3		
			rm.UL	Remote setpoint input low volts		
			rm.UH	Remote setpoint input high volts		
			rm.CL	Remote setpoint input low current		
			rm.CH	Remote setpoint input high current		
GO		To start the calibration sequence	no		no	Conf only
			YES	Start		
			buSY	Calibrating		
			PASS	Calibration successful		
			FAiL	Calibration unsuccessful		

8. Diagnostic Alarms

Diagnostic alarms indicate a possible fault within the controller or connected devices.

Display shows	What it means	What to do about it
EConF	A change made to a parameter takes a finite time to be entered. If the power to the controller is turned off before the change has been entered then this alarm will occur. Do not turn the power off to the controller while ConF is flashing	Enter configuration mode then return to the required operating mode. It may be necessary to re-enter the parameter change since it will not have been entered in the previous configuration.
ECAL	Calibration error	Re-instate Factory calibration
E2Er	EEPROM error	Return to factory for repair
EEEr	Non-vol memory error	Note the error and contact your supplier
ELin	Invalid input type. This refers to custom linearisation which may not have been applied correctly or may have been corrupted.	Go to the INPUT list in configuration level and set a valid thermocouple or input type
Emod	IO1, OP2, or OP3 has been changed	If this has been field changed by the installation of a new board, enter config level, then exit back to operator level. If the message occurs at any other time return to factory for repair.

8.1.1 Out of Range Indication

If the input is too high HHHHH will be displayed

If the input is too low LLLLL will be displayed

9. Digital Communications

Digital Communications (or 'comms' for short) allows the controller to communicate with a PC or a networked computer system. Digital communications is not available in 3116 controllers.

This product conforms to MODBUS RTU ® protocol a full description of which can be found on www.modbus.org.

Two ports are available both using MODBUS RTU communication facilities:

1. a configuration port - intended to communicate with a system to download the instrument parameters and to perform manufacturing tests and calibration
2. an optional RS232 or RS485 port on terminals HD, HE and HF - intended for field communications using, for example, a PC running a SCADA package.

The two interfaces cannot operate at the same time.

For a full description of digital communications protocols (ModBus RTU) refer to the 2000 series Communications Handbook, part number HA026230, available on www.eurotherm.co.uk.

Each parameter has its own unique ModBus address. A list of these is given at the end of this section.

9.1 Digital Communications Wiring

9.1.1 RS232

To use RS232 the PC will be equipped with an RS232 port, usually referred to as COM 1.

To construct a cable for RS232 operation use a three core screened cable.

The terminals used for RS232 digital communications are listed in the table below. Some PC's use a 25 way connector although the 9 way is more common.

Standard Cable	PC socket pin no.		PC Function *	Instrument Terminal	Instrument
Colour	9 way	25 way			Function
White	2	3	Receive, RX	HF	Transmit, TX
Black	3	2	Transmit, TX	HE	Receive, RX
Red	5	7	Common	HD	Common
Link together	1 4 6	6 8 11	Rec'd line sig. detect Data terminal ready Data set ready		
Link together	7 8	4 5	Request to send Clear to send		
Screen		1	Ground		

* These are the functions normally assigned to socket pins. Please check your PC manual to confirm.

9.1.2 RS485 (2-wire)

To use RS485, buffer the RS232 port of the PC with a suitable RS232/RS485 converter. The Eurotherm Controls KD485 Communications Adapter unit is recommended for this purpose. The use of a RS485 board built into the computer is not recommended since this board may not be isolated, which may cause noise problems, and the RX terminals may not be biased correctly for this application.

To construct a cable for RS485 operation use a screened cable with one (RS485) twisted pair plus a separate core for common. Although common or screen connections are not necessary, their use will significantly improve noise immunity.

The terminals used for RS485 digital communications are listed in the table below.

Standard Cable Colour	PC Function *	Instrument Terminal	Instrument Function
White	Receive, RX+	HF (B) or (B+)	Transmit, TX
Red	Transmit, TX+	HE (A) or (A+)	Receive, RX
Green	Common	HD	Common
Screen	Ground		

- These are the functions normally assigned to socket pins. Please check your PC manual to confirm .

See section 2.12 for wiring diagrams

9.2 Digital Communications Parameters

The following table shows the parameters available.

DIGITAL COMMUNICATIONS LIST 'comms'						
Name	**Scrolling Display**	**Parameter Description**	**Value**		**Default**	**Access Level**
I D	MODULE IDENTITY	Comms identity	nonE	No module fitted	As order code	Conf L3 R/O
			r232	RS 232 Modbus interface		
			r485	RS485 Modbus interface		
			r422	RS422 Modbus 3216 only		
			dc, P	Remote setpoint input. If fitted this ID replaces the above and no further parameters are shown		
ADDR	COMMUNICATIONS ADDRESS	Communications address of the instrument	1 to 254		1	L3
BAUD	COMMUNICATIONS BAUD RATE	Communications baud rate	1200	1200	9600	Conf L3 R/O
			2400	2400		
			4800	4800		
			9600	9600		
			19.20	19,200		
PRTY	COMMUNICATIONS PARITY	Communications parity	nonE	No parity	nonE	Conf L3 R/O
			EuEn	Even parity		
			Odd	Odd parity		
DELAY	RX/TX DELAY TIME	To insert a delay between Rx and Tx to ensure that drivers have sufficient time to switch over.	OFF	No delay		Conf L3 R/O
			on	Fixed delay applied		
Retran	COMMS RETRANSMISSION	Master comms broadcast parameter.	nonE	None	nonE	
			w.SP	Working setpoint		
			PV	Process Variable		
			OP	Output demand		
			Err	Error		
reg.ad	COMMS RETRANSMISSION ADDRESS	Parameter added in the Slave address to which the master communications value will be written	0 to 9999		0	

9.3 Modbus Parameter Addresses

Parameter Mnemonic	Parameter Name	Modbus Address
PV.IN	PV (Temperature) Input Value (see also Modbus address 203 which allows writes over Modbus to this variable).	1
TG.SP	Target Setpoint. ***NB – do not write continuously changing values to this variable. The memory technology used in this product has a limited (100,000) number of write cycles. If ramped setpoints are required, consider using the internal ramp rate function or the remote comms setpoint (Modbus address 26)in preference.***	2
MAN.OP	Manual Output Value	3
WRK.OP	Working Output	4
WKG.SP	Working Setpoint (Read Only)	5
PB	Proportional Band	6
Ti	Integral Time (0 = No Integral Action)	8
Td	Derivative Time (0 = No Derivative Action)	9
A1.---	Alarm 1 Threshold	13
A2.---	Alarm 2 Threshold	14
T.STAT	Timer Status 0 = Reset 1 = Run 2 = Hold 3 = End	23
SP1	Setpoint 1 ***NB – do not write continuously changing values to this variable. The memory technology used in this product has a limited (100,000) number of write cycles. If ramped setpoints are required, consider using the internal ramp rate function or the remote comms setpoint (Modbus address 26)in preference.***	24
SP2	Setpoint 2 ***NB – do not write continuously changing values to this variable. The memory technology used in this product has a limited (100,000) number of write cycles. If ramped setpoints are required, consider using the internal ramp rate function or the remote comms setpoint (Modbus address 26)in preference.***	25
OP.HI	Output High Limit	30
OP.LO	Output Low Limit	31
SP.RAT	Setpoint Rate Limit Value (0 = no rate limit)	35
StAt	Instrument Status. This is a bitmap: B0 – Alarm 1 Status B1 – Alarm 2 Status B2 – Alarm 3 Status B3 – Alarm 4 Status B4 – Auto/Manual Status B5 – Sensor Break Status B6 – Loop Break Status B7 – CT Low load current alarm status B8 – CT High leakage current alarm status B9 – Program End B10 – PV Overrange (by > 5% of span) B11 – CT Overcurrent alarm status B12 – New Alarm Status B13 – Timer/Ramp Running B14 – Remote (comms) SP Fail B15 – Autotune Status In each case, a setting of 1 signifies ‘Active’, 0 signifies ‘Inactive’.	75
A3.---	Alarm 3 Threshold	81
A4.---	Alarm 4 Threshold	82
Home	Home Display. 0 – Standard PV and SP display 1 – PV and Output Power display 2 – PV and Time remaining display 3 – PV and Timer elapsed time display 4 – PV and Alarm 1 setpoint 5 – PV and Load Current 6 – PV only 7 – PV and Composite SP/Time remaining	106

Parameter Mnemonic	Parameter Name	Modbus Address
	8 – Target setpoint 9 – No PV 10 – PV is not displayed when controller in Standby	
-	Instrument version number. Should be read as a hexadecimal number, for example a value of 0111 hex is instrument V1.11	107
ADDR	Instrument Comms Address	131

9.4 SPI Parameter Addresses

This instrument variant supports the following SPI Device types (no configuration is required, the devices automatically respond to requests made to these device types).

- Mold Temperature Controller (**DEVID 20**)
- Chiller (**DEVID 21**)
- Dryer (**DEVID 22**)
- Self Tuning General Purpose Temperature Controller (**DEVID 26**)
- General Purpose Temperature Controls (**DEVID 27**)

NB: The SPI variant of the 3200 controller supports only Fahrenheit units.

The SPI device address is set in the range 32..255 (hexadecimal 20 to FF) using the 'Addr' parameter in the Level 2 scroll list, or in the Level 3 'Comms' List.

9.5 DEVID 20, 21 & 22

Mold Temperature Controllers, Chillers, and Dryer DEVIDs support the following set of parameters.

9.5.1 ECHO

POLL: 20 20

SELECT: 20 21

FORMAT: Open – 4 Bytes

UNITS: ASCII

DESCRIPTION: Controller integrity command. Controller will accept and retain the data provided. The controller will provide the retained data in response to a poll enquiry.

VERSION

POLL: 20 22

SELECT: N/A

FORMAT: Open 4 bytes ASCII

UNITS: ASCII

DESCRIPTION: SPI version command. The controller will provide a fixed SPI version number (0400 for 3200).

SETPOINT PROCESS TEMPERATURE

POLL: 20 30

SELECT: 20 31

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Temperature at which the process is to be maintained.

ALARM, HIGH TEMPERATURE DEVIATION

POLL: 20 32

SELECT: 20 33

FORMAT: Numeric

UNITS: °F

DESCRIPTION: This Value in conjunction with the process setpoint determines at what temperature the high alarm will occur. It must always be positive. NB: in the 3200 this setpoint relates to the first configured alarm in the instrument and is therefore not necessarily a high temperature alarm.

ALARM, HIGH TEMPERATURE DEVIATION

POLL: 20 34

SELECT: 20 35

FORMAT: Numeric

UNITS: °F

DESCRIPTION: This Value in conjunction with the process setpoint determines at what temperature the low alarm will occur. It must always be positive. NB: in the 3200 this setpoint relates to the second configured alarm in the instrument and is therefore not necessarily a low temperature alarm.

STATUS PROCESS

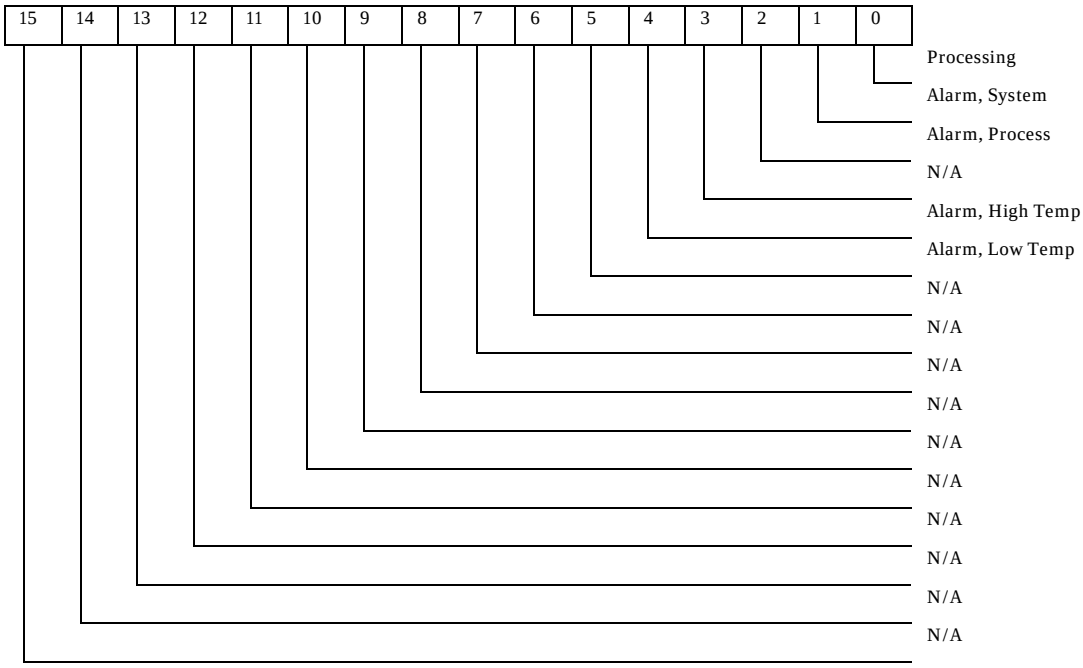
POLL: 20 40

SELECT: N/A

FORMAT: 16 Bits

UNITS: None

DESCRIPTION:



9.5.2 PROCESSING

BIT#: 0

DESCRIPTION: This status bit states whether this unit is currently processing.

0 = not currently processing (3200 manual mode)

1 = processing (3200 auto mode)

ALARM, SYSTEM

BIT#: 1

DESCRIPTION: This status bit states an alarm is present. In the 3200, this is set if any of the 4 temperature alarms are set, or if Sensor Break, Span Error, or Loop break is set.

ALARM, PROCESS

BIT# 2

DESCRIPTION: This bit indicates that an alarm that affects the process has occurred. In the 3200, this is set if any of the 4 alarms are set, or if Sensor Break, Span Error, or Loop break is set.

ALARM, HIGH TEMPERATURE

BIT#: 4

DESCRIPTION: This status bit states the temperature controller has exceeded its over setpoint deviation. This assumes the 3200 has been set up such that the first configured alarm (e.g. Alarm 2 if Alarm 1 is not configured) is a high alarm.

ALARM, LOW TEMPERATURE

BIT#: 5

DESCRIPTION: This status bit states the temperature controller has exceeded its below setpoint deviation. This assumes the 3200 has been set up such that the second configured alarm (e.g. Alarm 3 if Alarm 1 is not configured and Alarm 2 is a high alarm) is a low alarm.

STATUS, MACHINE 1

POLL: 20 42

SELECT: N/A

FORMAT: 16 Bits

UNITS: None

DESCRIPTION: Identical to definition of STATUS, PROCESS above

STATUS, MACHINE 2

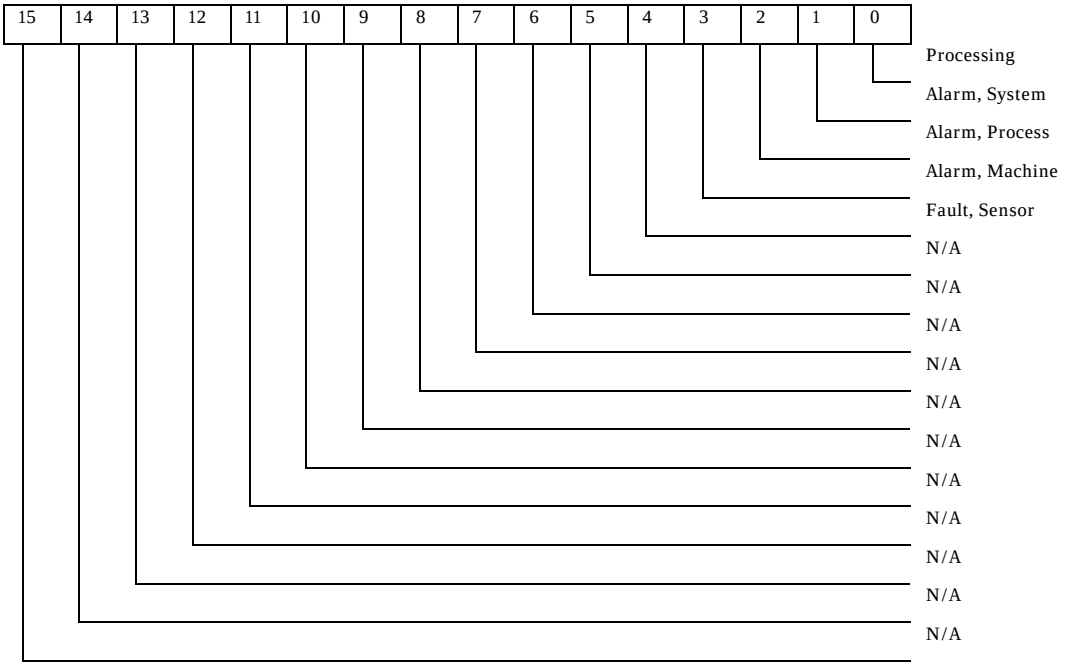
POLL: 20 44

SELECT: N/A

FORMAT: 16 Bits

UNITS: None

DESCRIPTION: Similar to definition of STATUS, PROCESS above



PROCESSING

BIT#: 0

DESCRIPTION: This status bit states whether this unit is currently processing.

0 = not currently processing (3200 manual mode)

1 = processing (3200 auto mode)

ALARM, SYSTEM

BIT#: 1

DESCRIPTION: This status bit states an alarm is present. In the 3200, this is set if any of the 4 temperature alarms are set, or if Sensor Break, Span Error, or Loop break is set.

ALARM, PROCESS

BIT# 2

DESCRIPTION: This bit indicates that an alarm that affects the process has occurred. In the 3200, this is set if any of the 4 alarms are set, or if Sensor Break, Span Error, or Loop break is set.

ALARM, MACHINE

BIT# 2

DESCRIPTION: This bit indicates that an alarm that affects the machine has occurred. Always set to 0 for 3200.

FAULT, SENSOR

BIT# 2

DESCRIPTION: This bit indicates a sensor error has been detected. Either sensor break or span error for 3200.

TEMPERATURE, TO PROCESS

POLL: 20 70

SELECT: N/A

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Returns the “To Process” Temperature

9.6 DEVID 26 & 27

The 3200 uses a single zone only (31).

Self Tuning General Purpose Temperature Controllers and General Purpose Temperature Controls support the following set of parameters.

9.6.1 ECHO

POLL: 20 20

SELECT: 20 21

FORMAT: Open – 4 Bytes

UNITS: ASCII

DESCRIPTION: Controller integrity command. Controller will accept and retain the data provided. The controller will provide the retained data in response to a poll enquiry.

VERSION

POLL: 20 22

SELECT: N/A

FORMAT: Open 4 bytes ASCII

UNITS: ASCII

DESCRIPTION: SPI version command. The controller will provide a fixed SPI version number (0400 for 3200).

PROCESS SETPOINT 1

POLL: 31 20

SELECT: 31 21

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Temperature at which the process is to be maintained.

PROCESS VALUE

POLL: 31 22

SELECT: N/A

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Present Actual Temperature of the process

PROPORTIONAL BAND 1

POLL: 31 24

SELECT: 31 25

FORMAT: Numeric

UNITS: ºF

DESCRIPTION: Proportional band for the primary control output in degrees

RESET 1 (INTEGRAL)

POLL: 31 28

SELECT: 32 29

FORMAT: Numeric

UNITS: Seconds

DESCRIPTION: Reset time for the primary control output in seconds (Integral term).

RATE 1 (DERIVATIVE)

POLL: 31 2A

SELECT: 32 2B

FORMAT: Numeric

UNITS: Seconds

DESCRIPTION: Rate time for the primary control output in seconds (Derivative term).

ALARM 1 SETPOINT

POLL: 31 2C

SELECT: 31 2D

FORMAT: Numeric

UNITS: ºF

DESCRIPTION: Temperature at which the first configured 3200 alarm is activated/deactivated.

ALARM ACTIVE STATUS

POLL: 31 2E

SELECT: N/A

FORMAT: Status

UNITS: None

DESCRIPTION: Set to '1' if there are any alarms active, otherwise 0.

ALARM 2 SETPOINT

POLL: 31 32

SELECT: 31 33

FORMAT: Numeric

UNITS: ºF

DESCRIPTION: Temperature at which the second configured 3200 alarm is activated/deactivated.

ALARM 1 RESET

POLL: N/A

SELECT: 31 35

FORMAT: Status

UNITS: None

DESCRIPTION: Write a value of 1 to acknowledge alarm conditions. Note that in the 3200, all alarms are acknowledged when this parameter is written to.

ALARM 2 RESET

POLL: N/A

SELECT: 31 37

FORMAT: Status

UNITS: None

DESCRIPTION: Write a value of 1 to acknowledge alarm conditions. Note that in the 3200, all alarms are acknowledged when this parameter is written to.

LOAD CURRENT VALUE

POLL: 31 40

SELECT: N/A

FORMAT: Numeric

UNITS: Amps

DESCRIPTION: Present actual current to the load.

CONTROLLER STATUS

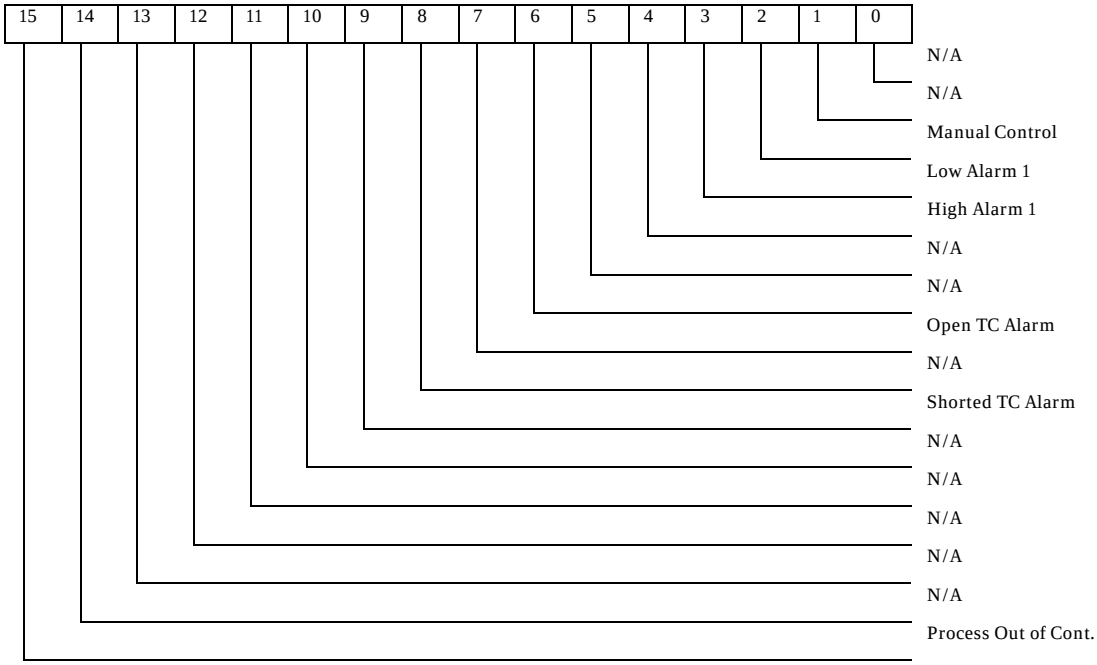
POLL: 31 44

SELECT: N/A

FORMAT: Status

UNITS: None

DESCRIPTION: Instrument status.



PROCESSING

BIT#: 0

DESCRIPTION: This status bit states whether this unit is currently processing.

0 = not currently processing (3200 manual mode)

1 = processing (3200 auto mode)

MANUAL CONTROL

BIT#: 2

DESCRIPTION: Indicates if the control is in manual (open loop) or automatic (closed loop) control.

0 = Automatic Control

1 = Manual Control (or standby)

LOW ALARM 1

BIT# 3

DESCRIPTION: Indicates that the first configured 3200 alarm is active. For example if Alarm 1 is not configured and Alarm 2 is set to be an absolute low alarm, this bit will be set if the temperature is lower than alarm setpoint 2.

HIGH ALARM 2

BIT# 4

DESCRIPTION: Indicates that the second configured 3200 alarm is active. For example if Alarm 1 is not configured, Alarm 2 is set to be an absolute low alarm, and Alarm 3 is set to be an absolute high alarm, this bit will be set if the temperature is higher than alarm setpoint 3.

OPEN TC ALARM

BIT# 7

DESCRIPTION: Indicates an open thermocouple condition (sensor break)

0 = TC normal

1 = TC open

SHORTED TC ALARM

BIT# 9

DESCRIPTION: Indicates a shorted thermocouple condition (overrange)

0 = TC normal

1 = TC overrange

PROCESS OUT OF CONTROL

BIT# 15

DESCRIPTION: Indicates controller is unable to maintain control of process. Requires that the 3200 'loop break time' is correctly set.

0 = Alarm not active

1 = Alarm active

AUTOTUNE PROPORTIONAL BAND 1

POLL: 31 46

SELECT: 31 47

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Autotune control proportional band in degrees. Same as "Proportional Band 1" in 3200.

AUTOTUNE RESET 1 (INTEGRAL)

POLL: 31 4A

SELECT: 32 4B

FORMAT: Numeric

UNITS: Seconds

DESCRIPTION: Autotune control reset time in seconds (Integral term). Same as "Reset 1" in 3200.

AUTOTUNE RATE 1 (DERIVATIVE)

POLL: 31 4E

SELECT: 32 4F

FORMAT: Numeric

UNITS: Seconds

DESCRIPTION: Autotune control rate time in seconds (Derivative term). Same as “Rate 1” in 3200.

AUTOTUNE CONTROLS

POLL: N/A

SELECT: 31 55

FORMAT: Status

UNITS: None

DESCRIPTION: Clear autotune parameters and begin autotune.

0 = No action

1 = Clear and start tuning

PROCESS SETPOINT 2

POLL: 31 5C

SELECT: 31 5D

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Setpoint 2: temperature at which the process is to be maintained.

MANUAL PERCENT OUTPUT

POLL: 31 6A

SELECT: 31 6B

FORMAT: Numeric

UNITS: Percent

DESCRIPTION: Percent of power output by the controller.

OPEN/CLOSE LOOP CONTROL

POLL: 31 8E

SELECT: 31 8F

FORMAT: Status

UNITS: None

DESCRIPTION: Determines if the controller is in open or closed loop control.

0 = Open loop control (manual or standby)

1 = Closed loop control (auto).

PROCESS TEMPERATURE DEVIATION

POLL: 31 AA

SELECT: N/A

FORMAT: Numeric

UNITS: °F

DESCRIPTION: Plus or minus temperature deviation from setpoint in degrees.

10. Remote Setpoint (Optional)

There are two inputs; 4-20mA and Volts which can be fitted in place of digital communications.

It is not necessary to fit an external burden resistor to the 4-20mA input.

If the 4-20mA remote setpoint input is connected and valid (>3.5mA; < 22mA) it will be used as the main setpoint. If it is not valid or not connected the controller will try to use the Volts input. Volts sensor break occurs at <-1; >+11V. The two inputs are not isolated from each other.

If neither remote input is valid the controller will fall back to the internal setpoint, SP1 or SP2 and flash the alarm beacon.

Be sure to set the Remote Hi Limit and Remote Lo Limit in the SETPOINT List.

11. Appendix A - Technical Specifications

Analogue Input

	Sample rate	4Hz (250mS)
	Calibration accuracy	±0.25% of reading ±1LSD
	Resolution	<5, 0.5µV when using a 5 second filter
	Linearisation accuracy	<0.1% of reading
	Input filter	Off to 59.9 secs
	Zero offset	User adjustable over the full display range
	Thermocouple Types	Refer to Sensor inputs and display ranges table
	Cold junction compensation	Automatic compensation typically >30 to 1 rejection of ambient temperature change or external reference 0°C (32°F)
	CJC Calibration accuracy	<±1.0°C at 25°C ambient
	RTD/PT100 Type	3-wire, Pt100 DIN43760
	Bulb current	0.2mA
	Lead compensation	No error for 22 ohms in all 3 leads
	Process Linear	-10 to 80mV, 0 to 10V with external potential divider module 100KΩ/800
	Current transformer	50mAac into 10 ohm. This burden resistor is fitted inside the controller
	Fusing	Fit a 2A type T fuse in line with this controller

Digital input

	Contact closure or logic 12V @ 5-40mA	
	Contact open >500Ω	
	Contact closed <200Ω	

Outputs

Relay	Rating: 2-pin relay	Min: 12V, 100mA dc Max: 2A, 264Vac resistive
	Rating: change-over, alarm relay	Min: 12V, 100mA dc Max: 2A, 264Vac resistive
	Application	Heating, cooling, alarms or valve position
Logic	Rating	On/High 12Vdc at 5 to 44mA
	Application	Off/Low <100mV <100µA
		Heating, cooling, alarms or valve position
Triac	Current at maximum continuous operation	0.75 A rms (resistive load)
	Minimum and maximum operating voltage	30V rms to 264V rms resistive
	Snubber (22nF & 100Ω)	RC snubber must be fitted externally to prevent false triggering under line transient conditions
DC analogue output	Rating	0-20mA or 4-20mA software configurable
	Maximum load resistance	500Ω
	Isolation	Not isolated from the sensor input
	Applications	Heating, cooling or retranmission

Communications

Digital	Transmission standard	EIA-485 2wire or EIA-232 at 1200, 2400, 4800, 9600, 19,200 baud
	Protocols	Modbus®
		SPI ®

Control functions

Control	Modes	PID or PI with overshoot inhibition, PD, PI, P only or On/Off or valve position
	Application	Heating and cooling
	Auto/manual	Bumpless transfer
	Setpoint rate limit	Off to 9999 degrees or display units per minute
Tuning	One-shot tune	Automatic calculation of PID and overshoot inhibition parameters
Alarms	Types	Full scale high or low. Deviation high, low, or band
	Modes	Latching or non-latching. Normal or blocking action
		Up to four process alarms can be combined onto a single output

Current Transformer Input

	Input current	0 to 50mA rms calibrated, 50/60Hz
	Scale	0 to 10, 25, 50 or 100Amps
	Input impedance	<20Ω
	Accuracy	±4% of reading
	Alarms	Leakage current, overcurrent
	Indication	Custom scrolling message and beacon
	Types	High, low, deviation band, sensor fault, load leakage current, over current, internal events
Recipes		
	Number	5
	Parameters stored	38
	Selection	Key press or via remote communications
General		
	Text Messages	10 x 30 character messages
	Dimensions and weight	48W x 48H x 90Dmm (1.89W x 1.89H x 3.54D in) 8.82oz (250g)
	Power Supply	100 to 240Vac -15%, +10%. 48 to 62Hz. 5 watts max
	Temperature and RH	Operating: 32 to 131°F (0 to 55°C), RH: 5 to 90% non-condensing.
	Storage temperature	-10 to 70°C (14 to 158°F)
	Panel sealing	IP 65, plug-in from front panel
	Safety standards	EN61010, installation category II (voltage transients must not exceed 2.5kV), pollution degree 2.
	Electromagnetic compatibility	EN61326-1 Suitable for domestic, commercial and light industrial as well as heavy industrial environments. (Class B emissions, Industrial Environment immunity).
		Low supply voltage versions are suitable for industrial environments only.
	Atmospheres	Not suitable for use above 2000m or in explosive or corrosive atmospheres.

12. Appendix B - ACS Custom Configuration Parameter List

12.1.1 Water Temp Unit

- ACS #: 724.00756.02
- Recipe Name: WAT

12.1.2 Hot Oil Unit

- ACS #: 724.00756.02
- Recipe Name: OIL

12.1.3 One Compressor Chiller – New (Effective (09/07)

- ACS #: 724.00756.02
- Recipe Name: 1CHL

12.1.4 Two Compressor Chiller – New (Effective 09/07)

- ACS #: 724.00756.02
- Recipe Name: 2CHL

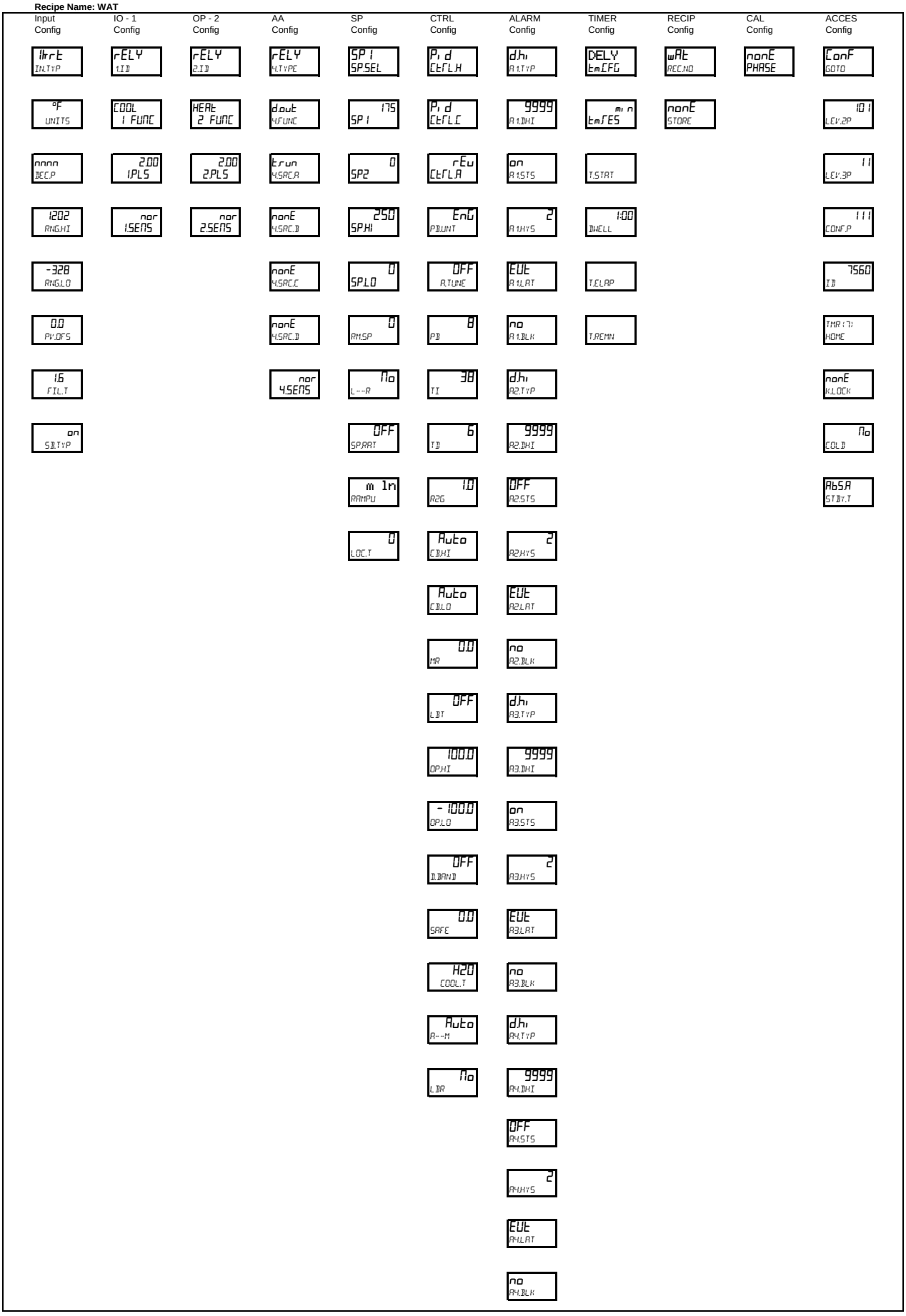
12.1.5 One Compressor Chiller – Retrofit

- ACS #: 724.00789.02
- Recipe Name: 1CHR

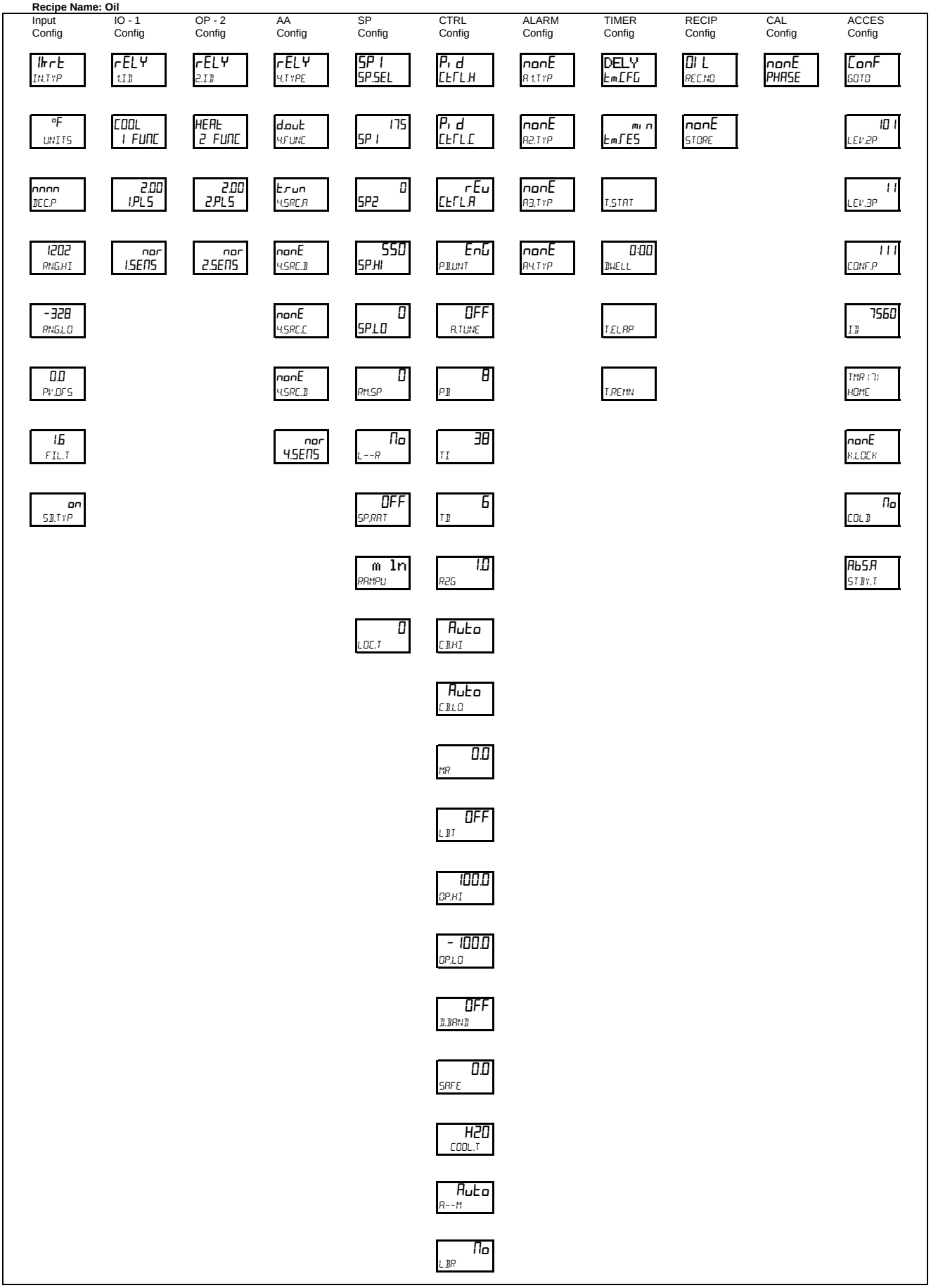
12.1.6 Two Compressor Chiller – Retrofit

- ACS #: 724.00789.02
- Recipe Name: 2CHR

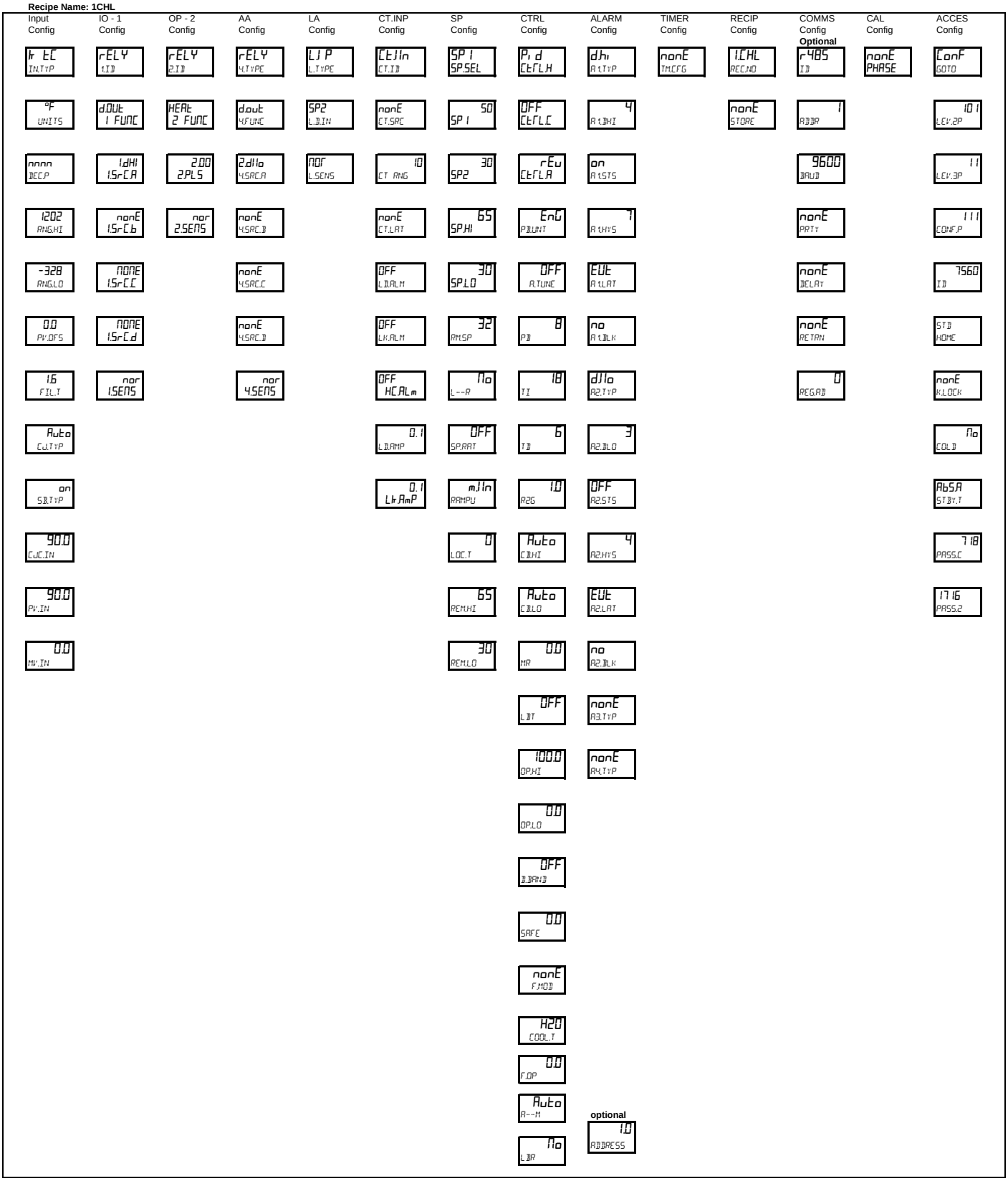
Water (TCU)
ACS#: 724.00756.02
Recipe Name: WAT



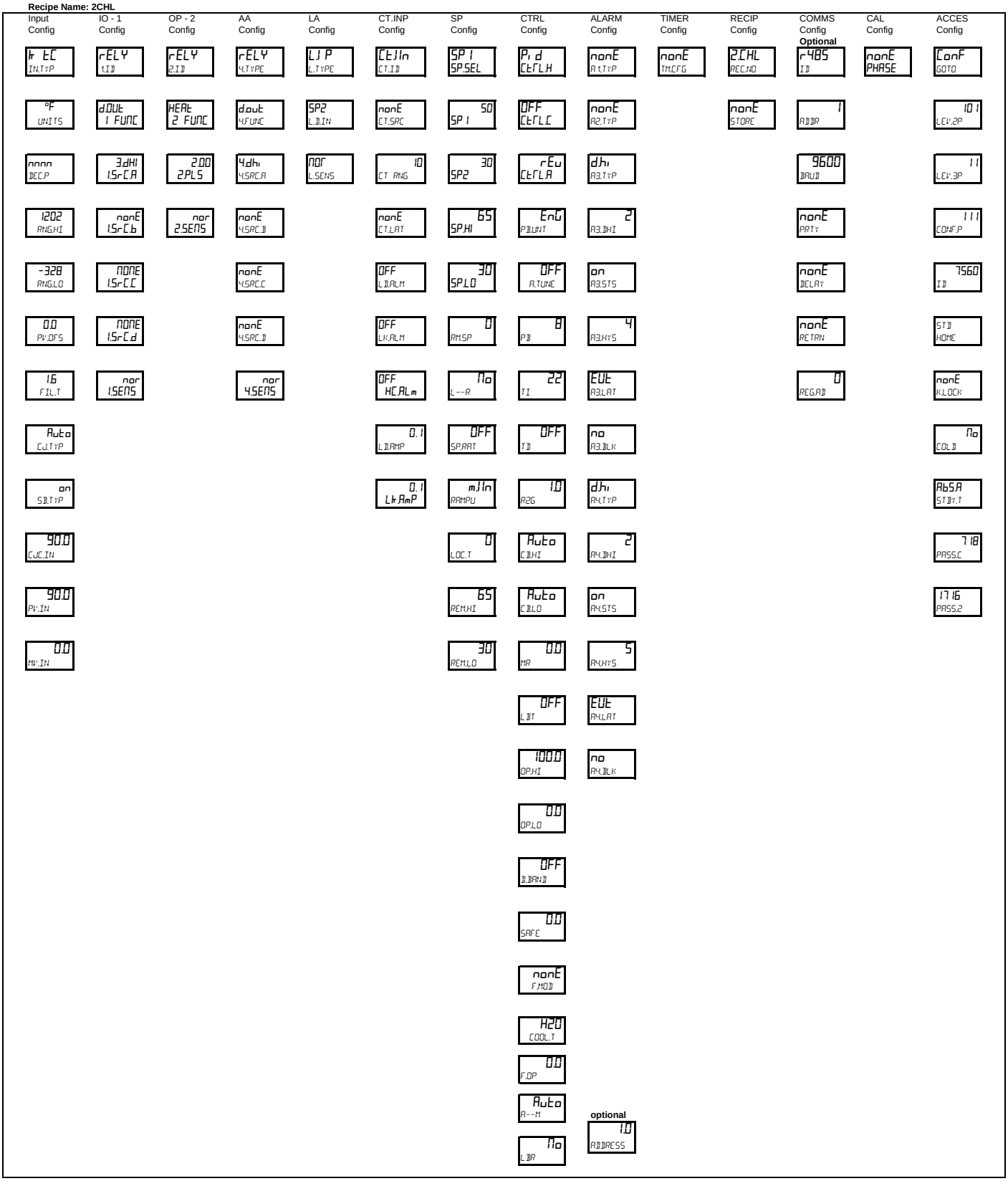
Hot Oil
ACS#: 724.00756.02
Recipe Name: Oil



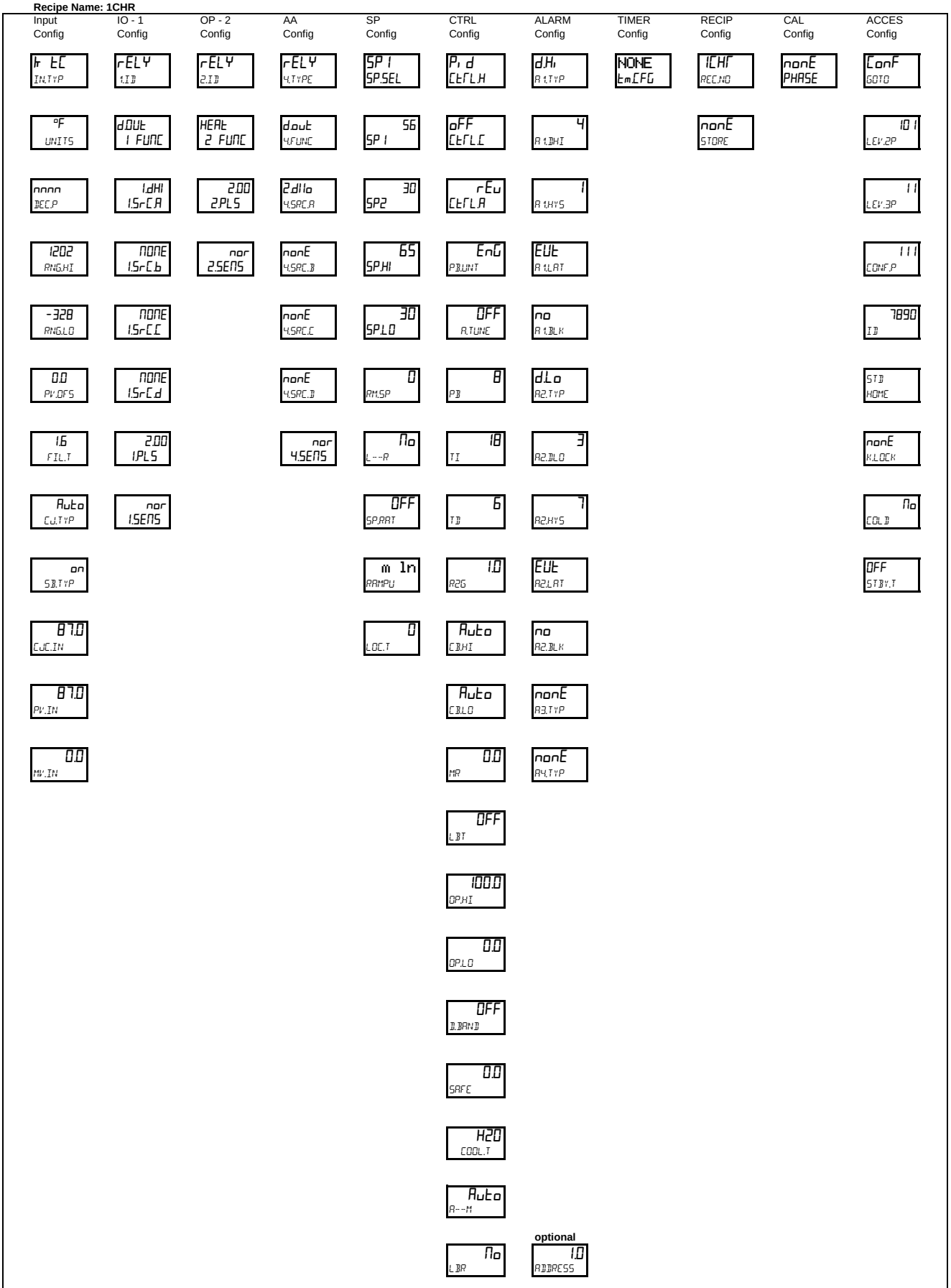
1 Compressor Chiller - New
ACS#: 724.00756.02
Recipe Name: 1CHL



2 Compressor Chiller - New
ACS#: 724.00756.02
Recipe Name: 2CHL



1 Compressor Chiller - Retrofit
ACS#: 724.00789.02
Recipe Name: 1CHR



2 Compressor Chiller - Retrofit
ACS#: 724.00789.02
Recipe Name: 2CHR